

Chapter 5

PLANT GROWTH REGULATORS (PGR)

Section A—General Information

5-1. Uses of PGRs. PGRs are applied to turf grass to retard or inhibit the grass' vertical shoot growth. They have potential to reduce mowing costs. They can have other uses, including: (1) controlling grass growth during wet periods in the spring, when frequent mowing is necessary but difficult to accomplish; (2) reducing the frequency of mowing where visual quality is not important; (3) reducing the need for mowing on steep slopes, along drainage ditches, roads and runways, and in other areas where mowing is difficult or dangerous.

5-2. Limitations of PGRs. PGRs sometimes have harmful effects on turf, and in some locations they are not consistently effective.

a. PGRs frequently discolor or kill grass tissues, increase the susceptibility of turf to disease, stimulate higher than normal growth rates after their regulatory effects have dissipated, reduce the recuperative capacity of turf, and decrease turf density. Reduced recuperative capacity occurs because little, if any, leaf, root, tiller, rhizome, or stolon development occurs in turf during the 6 to 8 week period after a growth regulator is applied. This effect precludes using PGRs on heavily trafficked turf areas, such as parade grounds and athletic fields where the turf's recuperative potential must be high. The thinning of turf grasses by PGRs, and the stress, insects, and disease that may follow their use, lead to weed encroachment. Because of these disadvantages, PGRs are normally recommended for use in low-maintenance and difficult-to-mow areas.

b. Using PGRs on grass species not on the label, or under unusual or stressful (i.e., hot and dry) environmental conditions, has serious risks. Most research with PGRs has been conducted on fescues, Kentucky bluegrass, perennial ryegrass, bermudagrass, bahiagrass, and centipedegrass in cool and moist environments, or transitional zone climates, not in tropical or arid regions. Also, there is little information on their effects on nonturf grass species or on weed grasses.

c. Applying PGRs to mixed stands may suppress the growth of some, but not all, species or cultivars in the stand. Failure to suppress the growth of even one species in a mixed stand may

forestall any significant reduction in mowing frequency. Also, continuous use of PGRs over several years may cause a shift from desirable turf grass species to other grasses and broadleaf weeds. Such a species shift can decrease the visual quality and utility of a stand, and could affect the foraging habits of birds and other wildlife.

5-3. Areas Where PGRs May Be Useful. There are many areas on military bases where PGRs might be used to advantage:

- a. Along runways and taxiways.
- b. In antenna fields.
- c. Around taxiway and runway lights, runway distance markers, fences, guardrails, telephone poles, power lines, guy wires, and buildings.
- d. On ammunition, weapon, and fuel storage embankments.
- e. In and around drainage ditches.
- f. In fenced-in areas such as electric transformers and radar antenna sites.
- g. In rights-of-way.
- h. On golf course roughs, driving ranges, and difficult to mow areas, such as adjacent to sand traps.
- i. In cemeteries.

5-4. Available PGRs:

a. The PGRs currently labeled for use on turf grasses are amidochlor, chlorflurenol, maleic hydrazide, and mefluidide. Each has limitations on application rates and the species to which it may be applied. These limitations are listed on the label. Information on these PGRs and their use is in attachments 4 and 21.

b. Two other PGRs may be registered in the near future:

(1) American Cyanamid Company (Princeton NJ 08540) will market imazethapyr plus imazapyr (trade name is Event) in 1989. Event effectively suppresses foliar growth of tall fescue, perennial ryegrass, Kentucky bluegrass, and bahiagrass. It also controls seedhead production of tall fescue and perennial ryegrass, and suppresses seedhead production in Kentucky bluegrass for 60 to 90 days.

(2) Elanco Products Co. (Indianapolis IN 46285) is expected to register flurprimidol (trade-name is Cutless) in 1989. Flurprimidol effectively suppresses the growth of cool-season

grasses, but does not suppress seedheads. Flurprimidol is root-absorbed and should be watered-in following application. It suppresses foliar growth for longer periods of time than other PGRs, but it may cause tip-browning of leaves. Flurprimidol may enhance tillering and rooting with continuous use, and it appears to have preemergence herbicidal activity against some weeds.

(3) The chemistry, toxicology, fate in the environment, suggested rates, and other pertinent information about these products can be obtained from the manufacturers after they have received full registration from the EPA.

Section B—Using PGRs

5-5. On-Site Evaluation. Using PGRs under local conditions for several years provides the best indication of their effectiveness and limitations.

a. On-site testing is the most reliable way to determine PGR usefulness and safety. Small test plots should be established at three or more locations containing vegetation that is representative of the general locale. Individual plots should be at least 200 ft² in size. An untreated check plot should be adjacent to the treated area for comparison. The PGRs should be applied to the same plots once or twice annually for a minimum of 2 years, following the directions on the label, so that the effects of different weather conditions on the response to the PGRs can be observed.

b. Notes and photographs taken before and after each application provide valuable information on the PGR performance and any adverse effects. Notes should be taken weekly until the growth regulator effects of the chemical have ended. Special attention should be given to the amount of discoloration and the length of time that it persists, the change in growth rate in comparison with the untreated turf, the length of time growth inhibition lasts, the presence or absence of seedhead production, the frequency of mowing needed, any thinning of the stand, any shifts in species present, weed encroachment, and any other adverse or beneficial effects. Although this is time consuming, it is the only means of developing a realistic program for using PGRs on large areas of land.

c. Judgement is required of the manager, if the use of PGRs is to be satisfactory. The following must be considered:

(1) Inhibition of growth persists for 6 to 8 weeks for most PGRs. However, inhibition may last 10 weeks or longer in some environments.

(2) Reapplication will be needed to achieve season-long growth inhibition.

(3) Reapplication, however, may cause severe discoloration and reduce stand density, and is generally not recommended for cool-season grasses in areas where heat and drought stress normally begin in late spring.

(4) Some periodic mowing will be needed to maintain the uniformity and appearance of treated turf, if its visual quality is a consideration.

(5) Mixed plant species, which would not be uniformly suppressed, may preclude the successful use of PGRs.

5-6. Complementary Practices. When PGRs are used, they should be part of an overall management program.

a. If the turf grass manager intends to use PGRs annually, he or she must be prepared to fertilize properly, to monitor and control weed encroachment, and to overseed areas where stand density begins to deteriorate. It is possible that some of the savings achieved in reduced mowings will have to be directed to such other management actions. It may be wise to skip PGR applications every third or fourth year to allow damaged turf to recuperate, particularly where it is growing on poor soil.

b. Because PGRs can injure turf, nitrogen fertilizers are important in enhancing the turf's recuperative capacity. This is important on droughty or low fertility soils. In low maintenance situations, it may be feasible to apply nitrogen only once annually. Nitrogen reduces the capacity of PGRs to inhibit growth. Therefore, it should be applied only after the desired growth regulator effects of the chemical have been achieved. The best time to apply nitrogen to Kentucky bluegrass, tall fescue, and other cool-season grasses in a single application is early autumn in temperate climates. For warm-season grasses, such as bermudagrass, nitrogen should be applied spring and early summer.

c. Weed encroachment into PGR-treated stands should be closely monitored and controlled with herbicides to enhance the competitive and recuperative capacity of the treated turfs. Weeds also greatly increase mowing frequency in PGR-treated areas and dramatically reduce the utility and aesthetic quality of turf.

Regulators can, and generally should be, tank-mixed with herbicides to control broadleaf weeds. When applying a PGR to cool-season grass containing broadleaf weeds, the PGR should be tank-mixed with 2,4-D in combination with at least one of the following: mecoprop (MCP), dicamba (do not use dicamba adjacent to, or under the drip line of, trees, shrubs, and ornamentals), dichlorprop, or triclopyr (attachment 11). Tank-mixing two or three broadleaf herbicides with a PGR increases the spectrum of herbicidal activity against various weed species. Read the labels of all the chemicals before tank mixing to guard against possible incompatibilities and other hazards.

d. Avoid drought stress, if possible, and monitor disease and insect activity in treated turf.

e. It may be necessary to overseed when environmental stresses and pests have badly injured PGR-treated stands. Cool-season turf grass species should be overseeded in the autumn with equipment that will ensure proper seed contact with the soil.

f. Periodic mowing will be needed to maintain uniformity and improve turf appearance in highly visible areas such as roadsides. Periodic mowing becomes increasingly important where the stand contains a mixture of different species. As previously noted, not all grasses in a mixed stand will be similarly retarded. Orchardgrass, velvetgrass, tall oatgrass, and *Trisetums* are less affected than most other grasses. Small spots of PGR-resistant grasses can be trimmed with hand-held mowers.

g. Turf grass areas treated with PGRs should not be subjected to more than occasional traffic of people, animals, and vehicles. PGR-treated turf has a reduced capacity to recuperate from injury while the inhibitory effects of the chemical persist.

h. There may be situations when growth inhibition by PGRs must be reversed. An application of 40 to 50 lb/a of actual nitrogen in a water-soluble fertilizer will enhance growth and partially reverse growth inhibition. For these fertilizers to be effective, they must be watered-in by irrigation or by a timely rainfall.

5-7. Applying PGRs:

a. PGRs should be applied no later in the spring than 2 weeks before seedheads normally appear. Turf to be treated should be mowed 24 to 48 hours before application, and it should be mowed again 2 to 3 weeks after application. Growth retardation lasts about 6 to 8 weeks.

Reapplication may be needed in late spring or early summer, if season-long inhibition is desired and if soil moisture is abundant. High visibility areas may require periodic mowing throughout the spring and summer to maintain a uniform appearance. Turf should not be allowed to develop severe drought stress, and the encroachment of weeds, insects, and diseases should be monitored.

b. PGRs appear to offer the most benefit when applied to cool-season grasses in early spring. An early application will greatly reduce the "spring flush" growth of Kentucky bluegrass, tall fescues, and other cool-season turf grasses. This may be particularly useful in the spring when frequent rainstorms can create difficult mowing conditions, especially on steep slopes, and when part-time labor for mowing may not be available.

c. In general, PGRs should be applied to cool-season turf grasses only once annually in areas where heat and drought stress begin by late spring. The single PGR application will inhibit the vigorous spring growth of the cool-season grasses, and environmental stress will inhibit the summer growth. A second application during the period of stress may be severely phytotoxic. Fall application to cool-season grasses should be considered only for dense, vigorously growing stands.

d. The warm-season grasses, unlike cool-season grasses, grow most vigorously during periods of high temperature in the summer. They generally are low-growing species such as bahiagrass, bermudagrass, carpetgrass, St. Augustinegrass, and zoysiagrass, that are maintained at low mowing heights in order to ensure vigorous, dense stands, and to reduce the potential for winterkill.

e. Warm-season grasses are normally treated to suppress seedheads rather than foliar growth. It is difficult to obtain season-long seedhead control with a single PGR application because many warm-season grasses produce seedheads continuously throughout the summer. Warm-season grasses also generally require higher application rates of PGRs than do the cool-season grasses.

f. Where warm-season grasses become dormant in winter, treatment should begin after spring greenup. In regions where warm-season grasses grow year-round, PGRs have had erratic effects, and therefore, they are generally not used on warm-season grasses in subtropical and tropical climates.

5-8. Step-by-Step Procedures. For best results, PGRs must be used correctly.

a. Mow turf to the desired height 24 to 48 hours before PGR application.

b. Apply PGRs to healthy, actively growing turf in the spring, about 2 weeks before seedheads appear.

c. Use the correct dosage and apply uniformly in 40 to 80 gallons of water per acre. Avoid runoff, skips, and overlaps.

d. Delay spraying if clippings or other debris are present, as they will prevent uniform distribution of the PGR.

e. Apply when rain is not expected for 4 to 8 hours and irrigation will not be provided for 8 hours. Amidochlor and flurprimidol, however, should be watered-in to improve their effectiveness.

f. Avoid high temperatures during or following PGR application, if possible. They will cause an increase in discoloration, and possibly thinning, of the turf grass.

g. Apply PGRs with a tractor-pulled, multi-nozzle, boom sprayer for best results. Spraying slopes and bunkers with a hand-held, single-nozzle boom often results in excessive or inadequate amounts of PGR being applied.

h. Do not apply PGRs to heat or drought stressed turf.

i. Do not apply PGRs to scalped turf.

j. Mow PGR treated turf 10 to 14 days after PGR application.

k. Do not scalp PGR-treated turf.

5-9. Diagnosing Common Problems. The most common problems associated with using PGRs may be diagnosed using the following chart:

| Problem | Problem Causes |
|---|--|
| a. Poor growth suppression or poor seedhead suppression | (1) insufficient PGR applied, poor calibration. |
| | (2) Turf mowed too close before PGR application. |
| | (3) PGR applied to dormant, partially dormant, or drought-stressed turf. |
| | (4) Rain or irrigation too soon after PGR application. |
| | (5) Turf mowed too soon after PGR application. |
| | (6) Germination of grass or broadleaf weed seed following PGR application. |
| | (7) PGR applied too late, after seedheads developed and began to emerge. |
| b. Abnormal discoloration | (1) Higher than recommended rate applied. |
| | (2) Overlapping of nozzles or spray boom. |
| | (3) Applied to sensitive species. |
| | (4) Turf mowed too close before application. |
| | (5) Turf mowed with dull mower blade before or after application. |